

ENERGY AND COMFORT

Ventilation Testing

**VELOCICALC®**  
**Air Velocity Meter**  
Model 9555 Series

Operation and Service Manual



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# Chapter 1

## **Unpacking and Parts Identification**

Carefully unpack the instrument and accessories from the shipping container. Check the individual parts against the list of components below. If anything is missing or damaged, notify TSI immediately.

1. Carrying case
2. Instrument
3. Static pressure tip
4. Rubber tubing
5. USB cable
6. CD-ROM with downloading software
7. AC adapter



# Chapter 2

## **Setting-up**

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### **Supplying Power to the Model 9555 Series**

The Model 9555 VELOCICALC Air Velocity Meter can be powered in one of two ways: four size AA batteries or the AC adapter.

#### **Installing the Batteries**

Insert four AA batteries as indicated by the diagram located on the inside of the battery compartment. The Model 9555 is designed to operate with either alkaline or NiMH rechargeable batteries. Battery life will be shorter if NiMH batteries are used. If NiMH batteries are used the DIP switch will need to be changed. Refer to Appendix B, [DIP Switch Settings](#). Carbon-zinc batteries are not recommended because of the danger of battery acid leakage.

#### **Using the AC Adapter**

When using the AC adapter, the batteries (if installed) will be bypassed. Be sure to provide the correct voltage and frequency, which is marked on the back of the AC adapter.

#### **Using The Telescoping Probe**

The telescoping probe contains the velocity, temperature, and humidity sensors. When using the probe, make sure the sensor window is fully exposed and the orientation dimple is facing upstream.

***NOTE: For temperature and humidity measurements, make sure that at least 3 inches (7.5 cm) of the probe is in the flow to allow the temperature and humidity sensors to be in the air stream.***

#### **Extending The Probe**

To extend the probe, hold the handle in one hand while pulling on the probe tip with the other hand. Do not hold the cable while extending the probe as this prevents the probe from extending.

#### **Retracting The Probe**

To retract the probe, hold the handle in one hand while gently pushing on the probe tip with the other hand. If you feel the probe antenna binding, pull gently on the probe cable until the smallest antenna section is retracted. Collapse the rest of the antenna by pressing the probe tip.

## Connecting the Optional Bluetooth Portable Printer

To connect the Bluetooth printer to the Model 9555, power on the unit and the printer. Then select the MENU soft key. From the Menu use the ▲ and ▼ keys to highlight Discover Printer and press the ↲ key. If other TSI Bluetooth-printers are in the area, turn them off before searching. The Model 9555 will then search for and list all available Bluetooth devices. Select the device "Handy700".

If the Model 9555 has previously been connected to a TSI printer, then it should automatically reconnect to that printer.

If the printer prints question marks (??????), asterisks (\*\*\*\*\*), or random characters, reset it by turning it off and then on again. If necessary, refer to the *Portable Printer Manual*.

## Connecting to a Computer

Use the Computer Interface USB Cable provided with the Model 9555 to connect the instrument to a computer for downloading stored data or for remote polling. Connect the end labeled "COMPUTER" to the computer USB port and the other end to the data port of the Model 9555.

For more information on how to download stored data see Chapter 3 section titled [TrakPro™ Data Analysis Software](#).



**Caution:** This symbol is used to indicate that the data port of the Model 9555 is **not** intended for connection to a public telecommunications network. Connect the USB data port only to another USB port.

# Chapter 3

## Operation

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### Keypad Functions

<b>ON/OFF Key</b>	Press to turn the Model 9555 on and off. During the power up sequence the display will show the following: Model Number, Serial Number, Software Revision and Last Date Calibrated.
<b>Arrow (▲▼) Keys</b>	Press to scroll through choices while setting a parameter. Pressing the ▲▼ keys simultaneously will lock the keypad to prevent unauthorized adjustments to the instruments. To unlock the keypad, press the ▲▼ keys simultaneously.
<b>↔ (Enter) Key</b>	Press to accept a value or condition.
<b>Arrow (◀ or ▶) and Menu Soft Keys</b>	Press arrow keys to change choices while setting a parameter. Press the Menu soft key to select the Menu selections, which are Display Setup, Pressure Zero, Settings, Flow Setup, Actual/Std Set up, Data Logging, Applications, Calibration and Printer.

### Common Terms

In this manual there are several terms that are used in different places. The following is a brief explanation of the meanings of those terms.

<b>Sample</b>	Consists of all of the measurement parameters stored at the same time.
<b>Test ID</b>	A group of samples. The statistics (average, minimum, maximum, and count) are calculated for each test ID. The maximum number of test IDs is 100.

<b>Time Constant</b>	The time constant is an averaging period. It is used to dampen the display. If you are experiencing fluctuating flows, a longer time constant will slow down those fluctuations. The display will update every second, but the displayed reading will be the average over the last time constant period. For example, if the time constant is 10 seconds, the display will update every second, but the displayed reading will be the average from the last 10 seconds. This is also referred to as a “moving average”.
<b>Logging Interval</b>	The logging interval is a frequency period that the instrument will log readings. For example, if the logging interval is set to 30 minutes, each sample will be the average of the last 30 minutes.

## Menus

### DISPLAY SETUP

Display setup menu is where you will setup the desired parameters to be displayed on the running screen. With a parameter highlighted you can then use the ON soft key to have it show up on the running screen or select the OFF soft key to turn off the parameter. Use PRIMARY soft key to have a parameter show up on the running screen in a larger display. Only one parameter can be selected as a primary, and up to 4 secondary parameters can be selected at one time.

### PRESSURE ZERO

To zero the pressure reading, select the Pressure Zero menu. The instrument will indicate if the pressure zero was successful.

### SETTINGS

Settings menu is where you can set the general settings. These include Language, Beeper, Select Units, Time Constant, Contrast, Set Time, Set Date, Time Format, Date Format, Number Format, Backlight and Auto Off. Use the **◀** or **▶** soft keys to adjust the settings for each option and use the **↔** key to accept settings.

### FLOW SET UP

In Flow Setup mode, there are 5 types: Round Duct, Rectangle Duct, Duct Area, Horn and K-Factor. Use the **◀** or **▶** soft keys to scroll through the types and then press the **↔** key to accept the desired type. To change the value, highlight the Enter Settings option and press the **↔** key.

**NOTE:** The horn numbers are the models of the horns. For example, 100 refers to a horn model number AM 100. Only horns with Model numbers as follows can be used with this function: AM 100, AM 300, AM 600 and AM 1200. If a horn model number is chosen, the instrument will return to measuring mode and use a preprogrammed curve to calculate flow rate from velocity.

## ACTUAL/STANDARD SETUP

Choose Actual/Standard measurements and parameters in the Act/Std Setup menu. Within this menu, the user can also select Standard Temperature, Standard Pressure and a source for the actual temperature. The Model 9555 measures the actual barometric pressure.

## DATA LOGGING

### Measurements

Measurements to be logged are independent of measurements on the display, and must therefore be selected under DATA LOGGING → Measurements.

### Log Mode/Log Settings

You can set Log Mode to Manual, Auto-save, Cont-key, Cont-time, Program 1 or Program 2.

- Manual mode does not automatically save data, but instead prompts the user to save a sample.
- In Auto-save mode, the user manually takes samples that are automatically logged.
- In Cont-key mode, the user starts taking readings and logging by pressing the ↲ key. The instrument will continue taking measurements until the ↲ key is pressed again.
- In Cont-time mode, the user starts taking readings by pressing the ↲ key. The instrument will continue taking samples until a set period of time has passed.
- Auto-save, Cont-Key and Cont-time modes have the following additional Log Settings:

<u>Mode</u>	<u>Log Settings</u>
Auto-save	Log Interval
Cont-key	Log Interval
Cont-time	Log Interval
	Test Length

- Pressing the **▲▼** keys simultaneously will lock the keypad to prevent unauthorized adjustments to the instruments. To unlock the keypad, press the **▲▼** keys simultaneously.

## **Delete Data**

Use this to delete all data, delete test or delete sample.

## **% Memory**

This option displays the memory available. Delete All, under Delete Data, will clear memory and reset the memory available.

## **APPLICATIONS**

You can choose Draft Rate, Heat flow, Turbulence and % Outside Air in the Applications menu. After choosing one of these applications, take measurements or enter data for each line.

## **Printing Data Using the Portable Printer**

To print logged data, first enter the DATALOGGING menu. Then, use the CHOOSE TEST item to select the data to be printed. After the test is selected, use the VIEW STATS and VIEW SAMPLES items to select statistics or individual data points to view and print. After selecting VIEW STATS or VIEW SAMPLES, press the PRINT key to print the data.

## **TRAKPRO™ Data Analysis Software**

The VELOCICALC Model 9555 comes with special software called TRAKPRO™ Data Analysis Software, which is designed to provide you with maximum flexibility and power. To install this software on your computer, follow the instructions on the label of the TRAKPRO software.

Follow the instructions on the label of the TRAKPRO software to install the software on your computer. TRAKPRO software contains a very comprehensive Help Function. This utility provides all the necessary information to guide you in all aspects of software operation. The software is shipped on a CD-ROM. Updates are available from the TSI website at <http://software.tsi.com>.

To download data from the Model 9555, connect the supplied computer interface USB cable to the Model 9555 and to a computer USB port. Any USB port from can be used.

# Chapter 4

## **Maintenance**

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The Model 9555 requires very little maintenance to keep it performing well.

### **Recalibration**

To maintain a high degree of accuracy in your measurements, we recommend that you return your Model 9555 to TSI for annual recalibration. Please contact one of TSI's offices or your local distributor to make service arrangements and to receive a Return Material Authorization (RMA) number. To fill out an online RMA form, visit TSI's website at <http://service.tsi.com>.

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The Model 9555 can also be recalibrated in the field using the CALIBRATION menu. These field adjustments are intended to make minor changes in calibration to match a user's calibration standards. The field adjustment is NOT intended as a complete calibration capability. For complete, multiple-point calibration and certification, the instrument must be returned to the factory.

### **Cases**

If the instrument case or storage case needs cleaning, wipe it off with a soft cloth and isopropyl alcohol or a mild detergent. Never immerse the Model 9555. If the enclosure of the Model 9555 or the AC adapter becomes broken, it must be replaced immediately to prevent access to hazardous voltage.

### **Storage**

Remove the batteries when storing the unit for more than one month to prevent damage due to battery leakage.



# Chapter 5

## Troubleshooting

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Table 5-1 lists the symptoms, possible causes, and recommended solutions for common problems encountered with the Model 9555. If your symptom is not listed, or if none of the solutions solves your problem, please contact TSI.

**Table 5-1: Troubleshooting the Model 9555**

<b>Symptom</b>	<b>Possible Causes</b>	<b>Corrective Action</b>
No Display	Unit not turned on	Switch unit on.
	Low or dead batteries	Replace batteries or plug in AC adapter.
	Dirty battery contacts	Clean the battery contacts.
Velocity reading fluctuates unstable	Fluctuating flow	Reposition probe in less-turbulent flow or use longer time constant.
No response to keypad	Keypad locked out	Unlock keypad by pressing <b>▲▼</b> keys simultaneously.
Instrument Error message appears	Memory is full	Download data if desired, then <b>DELETE ALL</b> memory.
	Fault in instrument	Factory service required on instrument.
Probe Error message appears	Fault in probe	Factory service required on probe.

### **WARNING!**

Remove the probe from excessive temperature immediately: excessive heat can damage the sensor. Operating temperature limits can be found in [Appendix A, Specifications](#). The pressure sensor is protected from damage up to 7 psi (48 kPa or 360 mmHg). At higher pressure it can burst!



# Appendix A

## Specifications

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Specifications are subject to change without notice.

### Velocity (TA Probe):

Range: 0 to 9999 ft/min (0 to 50 m/s)  
Accuracy<sup>1&2</sup>:  $\pm 3\%$  of reading or  $\pm 3$  ft/min ( $\pm 0.015$  m/s), whichever is greater  
Resolution: 1 ft/min (0.01 m/s)

### Velocity (Pitot Tube):

Range<sup>3</sup>: 250 to 15500 ft/min (1.27 to 78.7 m/s)  
Accuracy<sup>4</sup>:  $\pm 1.5\%$  at 2000 ft/min (10.16 m/s)  
Resolution: 1 ft/min (0.01 m/s)

### Duct Size:

Range: 1 to 250 inches in increments of 0.1 in.  
(1 to 635 cm in increments of 0.1 cm)

### Volumetric Flow Rate:

Range: Actual range is a function of actual velocity, pressure, duct size, and K factor

### Temperature (TA Probe):

Range: 14 to 140°F (-10 to 60°C)  
Accuracy<sup>5</sup>:  $\pm 0.5^{\circ}\text{F}$  ( $\pm 0.3^{\circ}\text{C}$ )  
Resolution: 0.1°F (0.1°C)

### Relative Humidity(TA Probe):

Range: 0 to 95% RH  
Accuracy<sup>6</sup>:  $\pm 3\%$  RH  
Resolution: 0.1% RH

### Wet Bulb Temperature (TA Probe):

Range: 40 to 140°F (5 to 60°C)  
Resolution: 0.1°F (0.1°C)

### Dew Point (TA Probe):

Range: 5 to 120°F (-15 to 49°C)  
Resolution: 0.1°F (0.1°C)

### Heat Flow (TA Probe):

Range: Function of velocity, temperature, humidity, and barometric pressure  
Measurements available: Sensible heat flow, latent heat flow, total heat flow and sensible heat factor  
Units measured: BTU/hr, kW

**Static / Differential Pressure:**

Range<sup>7</sup>: -15 to +15 in. H<sub>2</sub>O (-28.0 to +28.0 mm Hg, -3735 to +3735 Pa)  
Accuracy: ±1% of reading ±0.005 in. H<sub>2</sub>O (±1 Pa, ±0.01 mm Hg)  
±0.02%/°F (±0.03%/°C)  
Resolution: 0.001 in. H<sub>2</sub>O (1 Pa, 0.01 mm Hg)

**Barometric Pressure:**

Range: 20.36 to 36.648 in. Hg (517.15 to 930.87 mm Hg)  
Accuracy: 2% of reading

**Instrument Temperature Range:**

Operating (Electronics): 40 to 113°F (5 to 45°C)  
Operating (Probe): 14 to 140°F (-10 to 60°C)  
Storage: -4 to 140°F (-20 to 60°C)

**Instrument Operating Conditions:**

Altitude up to 4000 meters  
Relative humidity up to 80% RH, non-condensing  
Pollution degree 1 in accordance with IEC 664  
Transient over voltage category II

**Data Storage Capabilities:**

Range: 26,500+ samples and 100 test IDs (one sample can contain  
fourteen measurement types)

**Logging Interval:**

Intervals: 1 second to 1 hour

**Time Constant:**

Intervals: User selectable

**Response Time:**

Velocity: 200 msec  
Temperature: 2 minutes (to 66% of final value)  
Pressure: 0.1 msec  
Humidity: <1 minute (to 66% of final value)

**External Meter Dimensions:**

3.8 in. × 8.3 in. × 2.1 in. (9.7 cm × 21.1 cm × 5.3 cm)

**Meter Probe Dimensions:**

Probe length: 40 in. (101.6 cm)  
Probe diameter of tip: 0.28 in. (7.0 mm)  
Probe diameter of base: 0.51 in. (13.0 mm)

**Articulating Probe Dimensions:**

Articulating section length: 6.0 in. (15.24 cm)  
Diameter of articulating knuckle: 0.38 in. (9.5 mm)

**Meter Weight:**

Weight with batteries: 0.8 lbs (0.36 kg)

**Power Requirements:**

Four AA-size batteries (included) or AC adapter (optional) 7.2 VDC, 300 mA, 4-18 watts (input voltage and frequency vary depending on which adapter is used)

- 1 Temperature compensated over an air temperature range of 40 to 150°F (5 to 65°C).
- 2 The accuracy statement of  $\pm 3.0\%$  of reading or  $\pm 3$  ft/min ( $\pm 0.015$  m/s), whichever is greater, begins at 30 ft/min through 9999 ft/min (0.15 m/s through 50 m/s).
- 3 Pressure velocity measurements are not recommended below 1000 ft/min (5 m/s) and are best suited to velocities over 2000 ft/min. Range can vary depending on barometric pressure.
- 4 Accuracy is a function of converting pressure to velocity. Conversion accuracy improves when actual pressure values increase.
- 5 Accuracy with instrument case at 77°F (25°C), add uncertainty of 0.05°F/°F (0.03°C/°C) for change in instrument temperature.
- 6 Accuracy with probe at 77°F (25°C). Add uncertainty of 0.1% RH/°F (0.2% RH/°C) for change in probe temperature. Includes 1% hysteresis.
- 7 Overpressure range = 190 in. H<sub>2</sub>O (7 psi, 360 mmHg, 48 kPa).



## Appendix B

### **DIP Switch Settings**

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To access the DIP switch, remove the batteries from the battery compartment. On the inside of the battery compartment, there is a window with a single DIP switch (see Figure B-1). The table below shows the functions for the switch.

**Caution:** Make certain that power is turned off before changing the DIP switch settings.

Switch	Function	Settings
1	NiMH	OFF: Alkaline Batteries ON: NiMH Rechargeable Batteries



**Figure B-1: DIP Switch Location**

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Contact your local TSI Distributor or visit our website [www.tsi.com](http://www.tsi.com) for more detailed specifications.